SPECIFICATION

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CRASH NOTIFICATION SYSTEM FOR AN AUTOMOTIVE VEHICLE

Background of Invention

[0001] The present invention relates generally to crash sensing systems for automotive vehicles, and more particularly, to a crash notification system that notifies a response center to the severity and the number of occupants in the vehicle.Accident sensing systems typically use accelerometers to determine which safety devices to deploy. For example, a front accelerometer determines the deceleration of the vehicle. The restraints module deploys the front airbag in response to the deceleration being severe or above a predetermined amount. The deceleration corresponds to a crash impact on the front of the vehicle. Side airbag sensors operate in a similar manner in that a laterally mounted acceleration sensor measures the side deceleration on the vehicle due to a crash.Telematics systems are currently offered by various automakers. Such systems typically contact a response center in response to the deployment of the airbags. The response center then notifies the police that some type of accident has occurred. Such a system, however, does not provide an indication to the severity of the crash.U.S. Patent 5,969,598 uses a telematics system to generate a signal corresponding to the severity of the crash. The system uses a shock sensor to determine the amount of shock after the airbag deployment. One problem with such a system is that an inadequate response may be provided if several passengers are within the vehicle. That is, too few emergency vehicles and personnel may be initially dispatched to the accident scene.Therefore, it would be desirable to provide a crash notification system that provides an indication not only to the severity, but to the number of occupants of the vehicle so that adequate personnel may be dispatched to the scene.

Summary of Invention

[0002] The present invention provides a crash notification system that provides an indication as to the number of occupants of the vehicle. The crash notification system interfaces with a communication network. The crash notification system includes an occupant sensor that generates an occupant sensor status signal and a crash sensor generating a crash signal. A controller is coupled to the occupant sensor and a crash sensor. The controller generates a communication signal corresponding to the occupant sensor status signal and the crash status signal. Based upon the communication signal, a response center that is also coupled to the communication network may provide an appropriate response.

[0003] In a further aspect of the invention, a method for crash notification comprises generating an occupant sensor status signal; generating a crash signal; and generating a communication signal as a function of said occupant sensor status signal and said crash status signal; and coupling the communication signal to a communication network.

[0004] One advantage of the invention is that the severity level may be judged to merely send a tow truck upon a minor accident and can send the adequate number of emergency personnel should a more severe accident occur with several occupants.

[0005] Other advantages and features of the present invention will become apparent when viewed in light of the detailed description of the preferred embodiment when taken in conjunction with the attached drawings and appended claims.

Brief Description of Drawings

[0006] Figure 1 is a block diagrammatic view of a crash notification system according to the present invention.

[0007] Figure 2 is a flow chart illustrating a method for operating the crash notification system of the present invention.

Detailed Description

[0008] The following description is generated by way of example. Those skilled in the art will recognize various alternative embodiments and permutations of the present invention.

[0009] Referring now to Figure 1, an automotive vehicle 10 is illustrated having a crash notification system 12 according to the present invention. Crash notification system 12 has a controller 14. Controller 14 is preferably microprocessor-based and has a memory, I/O ports, and a CPU. Controller 14 may be a central controller within the vehicle or may be a plurality of separate controllers that communicate. For example, controller 14 may have a telematics control unit 16 and a restraints control module 18. More modules may be used such as a separate module for the rear seat sensors.

[0010] Telematics control unit 16 is coupled to a global positioning system (GPS) antenna 20. GPS antenna 20 receives signals from location satellites so that telematics control unit 16 can determine the position of the vehicle 10. Telematics control unit 16 also generates communication signals to a communication network 22.

[0011] Communication network 22 may, for example, be a cellular phone network or a satellite communication network. Communication network 22 generates communication signals to a response center 24. Response center 24 may then dispatch appropriate emergency personnel or other assistance as will be further described below. Communications may also be provided to the vehicle occupants from response center 24 through communication network 22. Thus, a two-way communication may be had.

[0012]

Restraints control module 18 is coupled to occupant sensors 30A, 30B, 30C, and 30D (collectively referred to as occupant sensors 30). Occupant sensors 30 may be one of a variety of types of occupant sensors including a weight-based sensor, an infrared, ultrasonic, or other types of sensors that sense the presence of a person within a seating position of the vehicle. Preferably, an occupant sensor is provided for each seating position. Occupant sensor 30A is positioned at the driver"s seat. Occupant sensor 30B is positioned at the passenger front seat. Occupant sensors 30C and 30D are illustrated in the rear position. Although only two rear occupant sensors 30C and 30D are illustrated, various numbers of rear occupant sensors may be employed depending on the type of vehicle. For example, three occupant sensors may be provided across the rear seat. Also, several rows of seating positions and thus several rows of occupant sensors may be provided in the seats of full-size vans, mini-vans, sport utility vehicles, and station wagons. The occupant sensors generate an

occupant sensor status signal that corresponds to the presence of an occupant in the various seating positions.

[0013] Restraints control module 18 may also be coupled to a plurality of seat belt switches 32A, 32B, 32C, and 32D (collectively referred to as seat belt switch 32.) Seat belt switches 32 generate a seat belt status signal corresponding to the buckle or unbuckled state of the seat belts in the various positions. Preferably, each of the seating positions has a seat belt switch. As illustrated, seat belt switch 32A corresponds to the driver seat belt switch. Seat belt switch 32B corresponds to the front passenger seat, seat belt switches 32C and 32D correspond to the rear seat belt switches.

[0014] Restraints control module 18 is also coupled to a front crash sensor 34 and side crash sensors 36A and 36B. Both front crash sensor and side crash sensors 36A and 36B are preferably accelerometer-based. The crash sensors thus generate a crash signal corresponding to a crash in the particular part of the vehicle in which the sensors are located. In response to a severe crash signal, front airbags 38A and/or 38B may be deployed. Likewise, when a severe side crash signal is generated from side sensors 36A and/or 36B, side airbags 40A and/or 40B may be deployed.

[0015] Based on this information the controller 14 may generate a communication signal to communication network 22 in response to the occupant sensor status signal, and the crash status signal. As well, the seat belt status signal may also be used to form the communication signal. In response to the communication signal, the response center 24 may be used to deploy the appropriate emergency level response.

[0016] Other sensors 42 may also be used by controller 14. For example, other sensors 42 may include the speed of impact, various accelerations, and the like. The direction of impact may also be determined but may be based on the input from crash sensors 34, 36A, and 36B.

[0017]

Referring now to Figure 2, the method for operating the crash notification system is described. In step 60, the various dynamic vehicle conditions are sensed. These may include the vehicle speed and the accelerations (decelerations) in the various directions provided by the crash sensors. The presence of the occupants in the

different positions is determined in step 62. In step 64 the seat belt status for the occupant positions is also determined by monitoring the seat belt switches 32. The crash severity may be determined in step 66. When the crash is a minor crash and thus below a first threshold in step 67, the system recycles to block 60. No emergency response is needed in this situation. In step 67 if the severity is not below a first threshold, step 68 is executed. Appropriate restraints may be deployed in step 68 in response to the crash severity.

[0018] Once a crash has occurred, the vehicle location may be sensed in step 70. The vehicle may constantly monitor vehicle locations such as before step 67 but this information is not needed until after a crash. In step 72 the data from steps 60-70 may be transmitted to a response center through the communication network. For example, the occupant status signal, the crash signals from one or more of the crash sensors may be used to form the communication signal. In addition, the seat belt status signal may also be included in forming the seat belt status signal. Preferably, the seat belt status signals and the occupant status signals from the front and rear seating positions are used in the formation of the communication word.

[0019] In step 74 the response center transmits the data to an emergency service provider. The emergency service provider determines what type of emergency response personnel to send based on the communication signal and the data therein. If the crash is not above a second threshold or not severe in step 76 then the crash requires a low level emergency response. For example, a tow truck or repair vehicle may be automatically dispatched to the accident scene based on the GPS information in step 78.

[0020] In step 76 when the severity is above a second threshold, a high level emergency response is deployed. In step 80, a high level emergency response corresponding to the number of potentially injured occupants may be deployed. In addition, the communication signal may include the number of occupants in the vehicle and the number of occupants that were belted using the seat belt status sensor. This information may be included in each transmission regardless of whether they are used. The acceleration of the front and side airbags may also be used to determine the severity of the crash.

[0021] It should also be noted the severity signal may be generated at the vehicle and included in the communication signal.

[0022] As can be seen, the present invention filters out nuisance emergency dispatches through the telematics control unit by establishing various thresholds of severity. Advantageously, the appropriate level of response corresponding to the number of occupants may thus be deployed.

[0023] While particular embodiments of the invention have been shown and described, numerous variations and alternate embodiments will occur to those skilled in the art. Accordingly, it is intended that the invention be limited only in terms of the appended claims.